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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Tuqiang Ni

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EXAMINER

ALEJANDRO MULERO, LUZ L

ART UNIT

PAPER NUMBER

1763

MAIL DATE

DELIVERY MODE

08/23/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

09/821,753

Applicant(s)

NI ET AL.

Examiner

Luz L. Alejandro

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 May 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 38-66 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 38-66 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 47-66 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The specification, as originally filed, does not provide support for "the AC etchant plasma always being the dominant material applied to the workpiece while the feature is being formed" as claimed in claim 47-lines 3-5 and claim 59-lines 9-10. Furthermore, it appears that using a deposition gas with an etching gas is taught in paragraph 0030 of the instant application.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of

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the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 38-46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chao et al., US 2002/0106845.

Chao et al. shows the invention substantially as claimed including a method of forming a rounded corner of a trench of a workpiece in a vacuum plasma chamber, comprising converting a gas species that is supplied to the chamber into an etchant plasma that is continuously applied to the workpiece while the rounded corner is being formed, and changing the power applied to the etchant plasma while the rounded corner is being formed (see paragraphs 0048-0049 and fig. 4D).

Chao et al. does not expressly disclose gradually changing the power applied to the etchant plasma such that the power does not remain constant for durations in excess of one second and at the same time maintaining constant the pressure in the chamber, the flow rate in the chamber, and the species flowing into the chamber. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to determine through routine experimentation the manner in which the power is changed and whether the pressure, flow rate, or species flowing into the chamber is constant or changed based upon a variety of factors including the desired

profile of the corner and such limitation would not lend patentability to the instant application absent a showing of unexpected results.

With respect to claims 38-39 and 43-44, note that the etchant gas is the dominant gas and the rounded corner is at an intersection of a wall of the trench and a surface intersecting the wall, the surface extending generally at right angles to the wall.

Concerning the amount the power is changed, it would have been obvious to one of ordinary skill in the art at the time the invention was made to determine through routine experimentation the optimum amount of time at which the power should remain constant and the optimum amount the power is changed, to achieve the desired rounded profile of the trench and such limitations would not lend patentability to the instant application absent a showing of unexpected results.

Claims 47-66 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bhardwaj et al., U.S. Patent 6,051,503 in view of Howald et al., WO 00/58992.

Bhardwaj et al. shows the process substantially as claimed including a method of etching a workpiece in a vacuum plasma processor chamber comprising converting a gas species into an AC etchant plasma that is applied to the workpiece while a desired shape of the workpiece is being formed, the AC etchant plasma always being the dominant material applied to the workpiece while the desired shape of the workpiece (for example, a portion of the sidewall of the trench) is being formed, the vacuum chamber being subject to operating at different pressures while the workpiece is being processed (see abstract), the gas species being subject to flowing into the chamber at

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different flow rates while the workpiece is being processed (also see abstract), gradually changing, the amount of AC power supplied to the plasma during etching of the workpiece to form a desired shape (see col. 6-lines 43-47 and abstract), wherein a gradual transition in the shape of material in the workpiece being processed occurs in response to the gradual power change, the gradual power change occurring during the gradual transition in the shape of the material that has a desired shape (see abstract, col. 6-lines 43-49, col. 8-line 57 to col. 9-line 26, and figs. 19A-19B). Note that inherently a gradual power change will also produce a rounded profile in Bhardwaj et al. since the gradual power change in the instant application similiarly produces a rounded profile.

Bhardwaj et al. fails to expressly disclose: wherein the gradual change is pre-programmed (use of a computer program). Howald et al. discloses a method of processing by etching (see page 1-lines 15-19) a workpiece in a vacuum plasma processor chamber including computers 20 and 34 and wherein a gas species is converted into an AC plasma (see page 6-lines 17-20). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of Bhardwaj et al. so as to include a process using the apparatus of Howald et al. because such an apparatus allows for a high level of control over the plasma process being performed. Moreover, with respect to the changes in power being pre-programmed, it would have been obvious to one of ordinary skill in the art at the time the invention was made to pre-program the power change into the microprocessors 20,34 of Howald et al. because in such a way operator error will be

eliminated. Moreover, merely using a computer to automate a known process does not by itself impart nonobviousness to the invention. See *Dann v. Johnston*, 425 U.S. 219, 227-30, 189 USPQ 257, 261 (1976); *In re Venner*, 262 F.2d 91, 95, 120 USPQ 193, 194 (CCPA 1958).

With respect to claims 49 and 61, note that the process can be conducted while no change is made in the species, the pressure, or the flow rate since the abstract of Bhardwaj et al. states only one or more of the parameters need to be changed.

Concerning claims 50-53 and 62-64, note that in Bhardwaj et al. the species is ionized into a plasma that etches the material to form the feature, the gradual power change (see abstract and col. 6-lines 43-49), the species, and the continuous application of the plasma to the workpiece being such that the material is shaped to have a rounded corner that includes the formed feature, which includes a trench wall having a lower rounded corner, in response to changes in the plasma etchant resulting from the gradual power change (note that by gradually changing the power the corner of the trench will be rounded similarly as in the instant application).

With respect to claims 54-58 and 65-66 concerning the specific time period to which the power remains at constant wattage and the amount the power is changed, it would have been obvious to one of ordinary skill in the art at the time the invention was made to determine through routine experimentation the optimum amount of time at which the power should remain constant and the optimum amount the power is changed, to achieve the desired rounded profile of the trench and such limitations would not lend patentability to the instant application absent a showing of unexpected results.

Response to Arguments

Applicant's arguments filed 05/24/07 have been fully considered but they are not persuasive. Applicant argues with respect to the rejection of claims 38-44 under 35 USC 103 that Chao does not disclose changing the power while the rounded corner is being formed. However, the reference clearly discloses the relationship between rounding the trench corners and increasing the power (see paragraph 0049). Furthermore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to determine through routine experimentation the optimum amount of time at which the power should remain constant and the optimum amount the power is changed, to achieve the desired rounded profile of the trench and such limitations would not lend patentability to the instant application absent a showing of unexpected results. Clearly, changing or not changing parameters such as the pressure, flow rate, or power would be part of the process of routine experimentation. Moreover, note that the arguments of counsel cannot take the place of evidence in the record.

Concerning newly added claims 47-66, note that any arguments with respect to the Chao reference are moot since the Chao reference is not used to reject these claims. Regarding the previously applied rejection to these claims of Bhardwaj et al. in view of Howald et al., applicant argues that the desired shape is a wall of the trench, not a portion of a wall of the trench. However, this is speculation by applicant and the examiner respectfully submits that the interpretation by the examiner is correct when giving the claim its broadest reasonable interpretation. Regarding applicant's argument

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that there are sharp changes in the RF power in the Bhardwaj et al. reference, the examiner submits that, for example, graph #3 of Fig 9(i) shows a gradual increase in the RF power as claimed.

Applicant additionally argues that there is no rounding of the corners in the Bhardwaj et al. reference. However, the examiner respectfully submits that if the power is gradually changed in the Bhardwaj et al. reference similarly to the claimed invention, then some rounding of the corners inherently will be expected to occur.

Concerning the declarations filed under 37 CFR 1.132, the declaration by Mr. Bailey argues that there is support in the specification of the instant application for "the AC etchant plasma always being the dominant material applied to the workpiece...". However, the examiner respectfully submits that there is no written description for the absolute limitation of the etchant material **always** being the dominant material since clearly the rounded corners can be formed if the etchant material is not the dominant material one hundred percent of the time. With respect to the argument in the declaration by Mr. Bailey that the Bhardwaj et al. reference does not show the etchant plasma being the dominant material, the examiner submits that if the feature formed is taken to be a portion of the wall of the trench then clearly this limitation is shown.

Regarding the declaration under 37 CFR 1.132 of Mr. Kamp, note that the claims are not commensurate in scope with the attempted showing of unexpected results. For example, the claims do not state that a soft etch is not required after the rounding of the trench corners.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

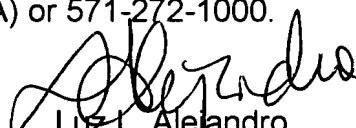
A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Luz L. Alejandro whose telephone number is 571-272-1430. The examiner can normally be reached on Monday to Thursday from 7:30 to 6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.


Luz L. Alejandro
Primary Examiner
Art Unit 1763

August 20, 2007